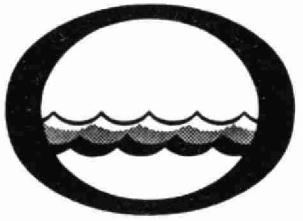
# 1971 OPERATING SUMMARY





# NORTH BAY

# WATER POLLUTION CONTROL PLANT



*Water management in Ontario*

Ontario
Water Resources
Commission

We are pleased to submit for your consideration a summary of operation during 1971 of the water pollution control plant serving your community.

This operating summary contains parameters normally used to measure plant performance and loading, as well as relevant cost data. Because of the concern over eutrophication of our lakes and of the requirement, in many parts of Ontario, to remove the major contributing factor, results of analysis for phosphorus appear in this summary.

D. S. Caverly,
General Manager.

D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

# NORTH BAY

# WATER POLLUTION CONTROL PLANT

operated for

THE CITY OF NORTH BAY

by the

ONTARIO WATER RESOURCES COMMISSION

## 1971 ANNUAL OPERATING SUMMARY

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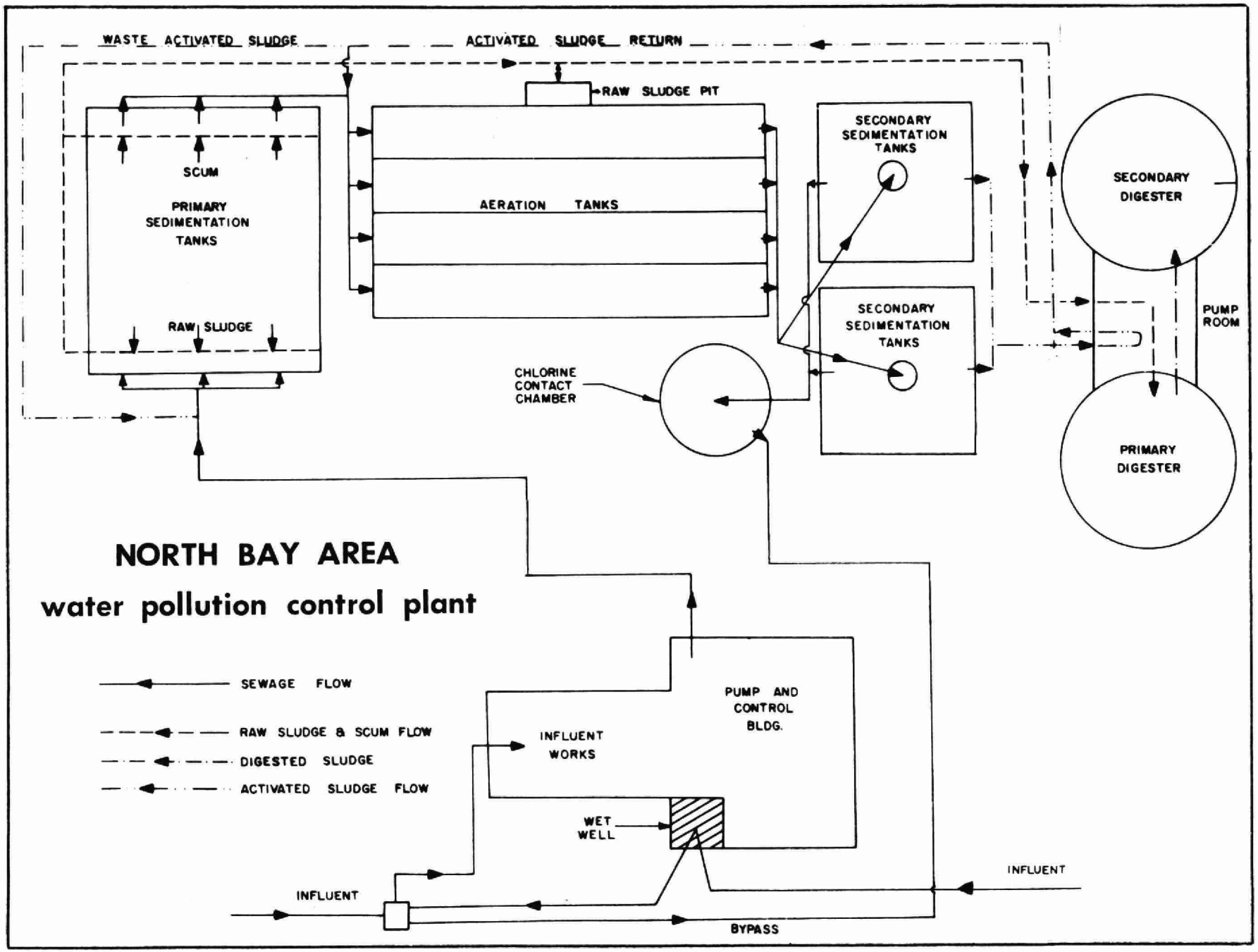

WASTE ACTIVATED SLUDGE
ACTIVATED SLUDGE RETURN
RAW SLUDGE PIT
SCUM
PRIMARY SEDIMENTATION TANKS
RAW SLUDGE
AERATION TANKS
SECONDARY SEDIMENTATION TANKS
SECONDARY SEDIMENTATION TANKS
SECONDARY DIGESTER
PUMP ROOM
PRIMARY DIGESTER
CHLORINE CONTACT CHAMBER
NORTH BAY AREA
water pollution control plant
SEWAGE FLOW
RAW SLUDGE & SCUM FLOW
DIGESTED SLUDGE
ACTIVATED SLUDGE FLOW
PUMP AND CONTROL BLDG.
INFLUENT WORKS
WET WELL
INFLUENT
INFLUENT
BYPASS

# DESIGN DATA

| | |
|---|---|
| PROJECT NO. | 2-0010-58 |
| TREATMENT | Activated Sludge |
| DESIGN FLOW | 4.0 mgd |
| DESIGN POPULATION | 50,000 |
| BOD - Raw Sewage | 150 mg/l |
| - Removal | 85% |

## PRIMARY TREATMENT

### Grit Removal

Type: Walker CRG
Size: Two $11\frac{1}{2}$ X $11\frac{1}{2}$ X 2'(3,300 gal)
Retention: 1.2 min
Flow Velocity: 0.163 fps

### Comminution

- Two Griductors (Infilco)

### Sewage Lift Pumps

Type: Chicago Pumps
Size: Two 4 mgd (gas)
One 4 mgd (electric)

### Primary Sedimentation

Type: Hardinge
Size: Three 90 X 30 X 10'
(0.505 mil gal)
Retention: 3 hr
Loading: Surface, 500 gal/$ft^2$/day
Weir, 44,000 gal/ft/day

## SECONDARY TREATMENT

### Aeration Tanks

Type: Diffused air, single-pass
Size: Four 185 X 20 X 12'
(1.1 mil gal)
Retention: 6.4 hr
Loading: 4,200 lb BOD/day

### Air Supply

Type: Roots
Size: Two 3750 cfm @ 7 psi

### Diffusers

Type: Spargers
Spacing: 70 @ $22\frac{1}{2}$")
14 @ 155/8") per tank
32 @ $13\frac{1}{2}$")

### Secondary Sedimentation

Type: Walker RSX
Size: Two 60 X 60 X 11' (500,000 gal)
Retention: 3 hrs
Loading: Surface, 550 gal/$ft^2$/day
Weir, 8,000 gal/ft/day

## CHLORINATION

Type: BIF semi-automatic
Size: One 500 lb/day

### Chlorine Contact Chamber

Size: One 34' dia x $12\frac{1}{2}$' (71,000 gal)
Retention: 25 min

## OUTFALL

- 1000 ft into Lake Nippissing

## SLUDGE HANDLING

### Digestion System - Two-stage

Primary --
Type: Dorr (3 draft tube mixers)
Size: One 65' dia (70,000 cu ft or
0.436 mil gal)
Loading: 2.4 lb/cu ft/mo

Secondary --
Size: One 65' dia (74,000 cu ft or
0.46 mil gal)
Total Loading: 1.2 lb/cu ft/mo

# '71 Review

## GENERAL

The North Bay sewerage system consists of a 4.0 MGD secondary treatment plant, sewers and approximately 20 pumping stations of which only the plant, some sewers and five pumping stations are financed by the OWRC. A plant staff of seven members operate the OWRC facilities and in addition provide emergency service and electrical maintenance to the city-owned pumping stations.

The plant operated less efficiently in 1971 than in the previous year. Flows to the plant were approximately 6 percent less however, the raw sewage organic strength increased by 45 percent. This resulted in serious odour problems in the proximity of the plant. The odour problems were corrected by staff before the year-end.

The preparation of final plans and specifications for the plant expansion commenced in 1971. The expansion (to 8.0 MGD) will involve essentially the provision of a new raw sewage pumping station, additional primary and secondary clarifiers, two additional digesters, phosphorus removal facilities and modifications to the existing main building. The scheduled starting date for construction is May 1972 and the completion date December, 1973.

A full scale phosphorus removal study started in December and continued until March 31, 1972. The entire cost for this program was financed by the OWRC through Federal and Provincial grants slated for this purpose.

## EXPENDITURES

The total operating cost of $152,350.02 represented an increase of 8.9 percent over the previous year and was due mainly to increased sludge haulage costs.

## PLANT FLOWS and CHLORINATION

A total flow of 1863 million gallons was treated in 1971. This represents an average daily flow of approximately 5.1 MGD and compares with 5.4 MGD in 1970 and 4.9 MGD in 1969. The reduction in total flows to the plant is indicative of the sewer rehabilitation work being carried out by the City.

The average daily flows exceeded the design capacity of 4 MGD 90 percent of the time, 5.0 MGD 50 percent of the time and 6.0 MGD nine percent of the time.

The plant effluent was chlorinated for a period of 6 months from May 1 to October 31. A total of 52,000 pounds of chlorine was used to maintain a residual of 0.5 mg/l in the effluent. Due to increased organic loading and poor treatability the Sanitary Engineering Branch requested that chlorination be carried out continuously and that a residual of 1.0 mg/l be maintained for a contact period of 15 minutes. This change will be implemented in 1972.

## PLANT PERFORMANCE

The average raw sewage strength of 186 mg/l BOD represented a 45 percent increase over the previous year. The suspended solids concentration of 203 mg/l represented a decrease of 17 percent from the previous year. The final effluent BOD and suspended solids concentrations of 47 mg/l and 46 mg/l respectively represented increases of 6 percent BOD and 10 percent suspended solids over 1970.

The average BOD reduction was 75 percent and the average suspended solids reduction, 77 percent. The reductions obtained in a well operating secondary treatment plant are in the order of 90 percent for both BOD and suspended solids.

## AERATION

The average BOD loading of 137 mg/l to the aeration section was approximately 45 percent greater than in 1970. This resulted in odour problems and an F/M ratio of 0.5. An average of 2200 cubic feet of air per pound of BOD removed was applied.

## SLUDGE DIGESTION and DISPOSAL

A total of 13, 400, 000 gallons of raw sludge was pumped to the primary digester at an average concentration of 3.9 percent total solids. Digestion reduced the total quantity to 5, 350, 000 gallons of sludge at a solids concentration of 3.4 percent. The digested sludge was removed from the plant by tank truck.

## CONCLUSIONS

The plant operated less efficiently in 1971 than in the previous year due to an increased organic loading. Odour problems which developed as a result of this increased loading were solved later in the year. The plant design flow of 4.0 MGD was exceeded 90 percent of the time.

Construction for the plant expansion to 8.0 MGD should commence in the spring of 1972.

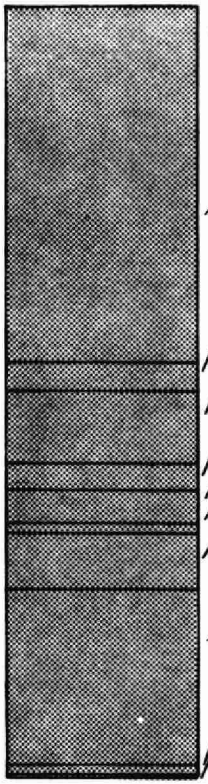
# PROJECT COSTS

| | |
|---|---|
| NET CAPITAL COST (Final) | $2,364,204.73 |
| DEDUCT - Portion financed by CMHC/MDLB (Final) | 50,000.00 |
| Long Term Debt to OWRC | $2,314,204.73 |
| Debt Retirement Balance at Credit (Sinking Fund) December 31, 1971 | $ 710,412.15 |
| Net Operating | $ 157,916.82 |
| Debt Retirement | 18,083.00 |
| Reserve | 8,765.89 |
| Interest Charged | 129,794.44 |
| TOTAL | $ 314,560.15 |

RESERVE ACCOUNT

| | |
|---|---|
| Balance @ January 1, 1971 | $ 156,661.01 |
| Deposited by Municipality | 8,765.89 |
| Interest Earned | 10,233.40 |
| | $ 175,660.30 |
| Less Expenditures | 5,345.85 |
| Balance @ December 31, 1971 | $ 170,314.45 |

# 1971 COSTS

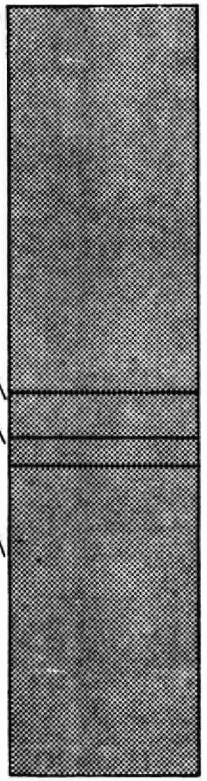


## OPERATING COSTS

| | |
|---|---|
| PAYROLL | 46 % |
| FUEL | 4 % |
| POWER | 10 % |
| CHEMICALS | 3 % |
| GENERAL SUPPLIES | 4 % |
| EQUIPMENT | 1 % |
| REPAIRS & MAINTENANCE | 8 % |
| SUNDRY | 22 % |
| WATER | 2 % |
| TRAVEL | <1 % |

## TOTAL ANNUAL COST

| | |
|---|---|
| NET OPERATING | 50 % |
| DEBT RETIREMENT | 6 % |
| RESERVE | 3 % |
| INTEREST | 41 % |



### YEARLY OPERATING COSTS

| YEAR | SEWAGE TREATED in million gallons | TOTAL OPERATING COSTS | TREATMENT COSTS $ per million gal | TREATMENT COSTS ¢ per lb BOD |
|---|---|---|---|---|
| 1967 | 1438.2 | $ 94,418.15 | $65.65 | 4 cents |
| 1968 | 1545.4 | 106,231.28 | 68.74 | 4 cents |
| 1969 | 1777.2 | 121,522.69 | 68.38 | 7 cents |
| 1970 | 1957. | 139,983.43 | 71.52 | 7 cents |
| 1971 | 1863. | 157,916.82 | 84.90 | 5 cents |

# MONTHLY OPERATING COSTS

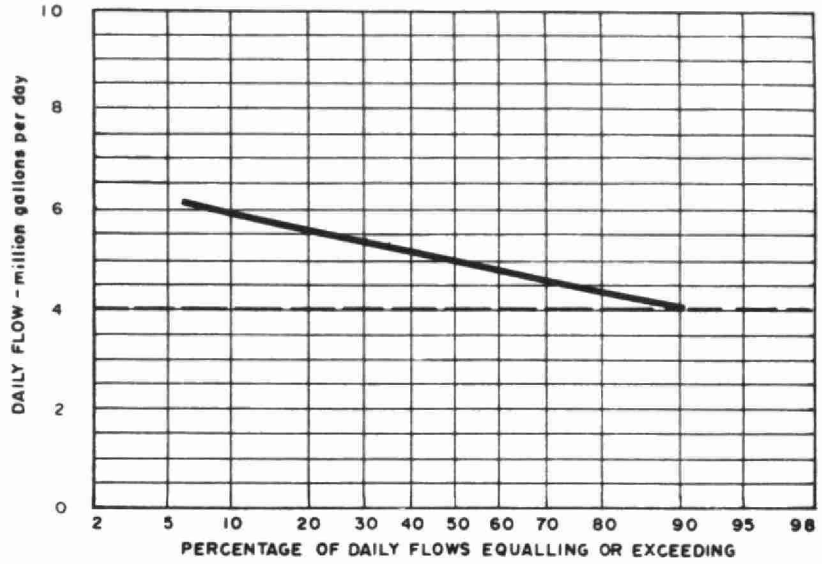
| MONTH | TOTAL EXPENDITURE | REGULAR PAYROLL | CASUAL PAYROLL | FUEL | POWER | CHEMICALS | GENERAL SUPPLIES | EQUIPMENT | REPAIRS and MAINTENANCE | SUNDRY* | WATER | TRAVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 5011.29 | 4732.23 | - | - | 142.98 | - | 71.00 | - | 65.08 | | | |
| FEB | 12324.11 | 6738.77 | - | 596.98 | 1374.84 | - | 346.30 | - | 206.16 | 2935.87 | 125.19 | |
| MAR | 10329.14 | 4566.11 | - | 609.85 | 1250.56 | - | 755.63 | - | 355.78 | 2616.02 | | 175.19 |
| APR | 8610.71 | 4068.23 | 352.62 | 520.93 | 1261.01 | - | 219.89 | 164.64 | 1641.53 | 262.84 | 119.02 | |
| MAY | 17157.85 | 4484.37 | 1223.51 | 513.14 | 1329.84 | 2440.20 | 488.80 | - | 1244.45 | 5299.04 | 134.50 | |
| JUNE | 13961.56 | 4809.25 | 525.89 | 481.10 | 1367.30 | - | 449.24 | 219.25 | 3217.64 | 2466.68 | 425.21 | |
| JULY | 13550.04 | 4455.22 | 991.95 | 415.57 | 1388.36 | - | 768.85 | 21.41 | 307.38 | 5086.06 | 115.24 | |
| AUG | 9134.86 | 4346.34 | 886.58 | 424.86 | 1266.95 | (4.78) | 405.33 | 764.19 | 88.96 | 357.46 | 543.24 | 55.73 |
| SEPT | 16780.58 | 3843.69 | 861.64 | 450.11 | 1494.46 | - | 639.90 | - | 446.96 | 9043.82 | | |
| OCT | 12179.32 | 7527.81 | 830.60 | 278.23 | 1346.48 | - | 265.80 | 9.92 | 1352.29 | 88.31 | 479.88 | |
| NOV | 15835.76 | 5999.33 | 1024.88 | 258.98 | 1378.95 | (116.20) | 534.88 | - | 960.34 | 4668.76 | 1118.16 | 7.68 |
| DEC | 17474.80 | 6955.77 | 897.86 | 903.60 | 1480.76 | 2587.00 | 1384.73 | 74.24 | 1675.64 | 1204.28 | 310.92 | |
| TOTAL | 152350.02 | 62527.12 | 7595.53 | 5453.35 | 15082.49 | 4906.22 | 6330.35 | 1253.65 | 11562.21 | 34029.14 | 3371.36 | 238.60 |

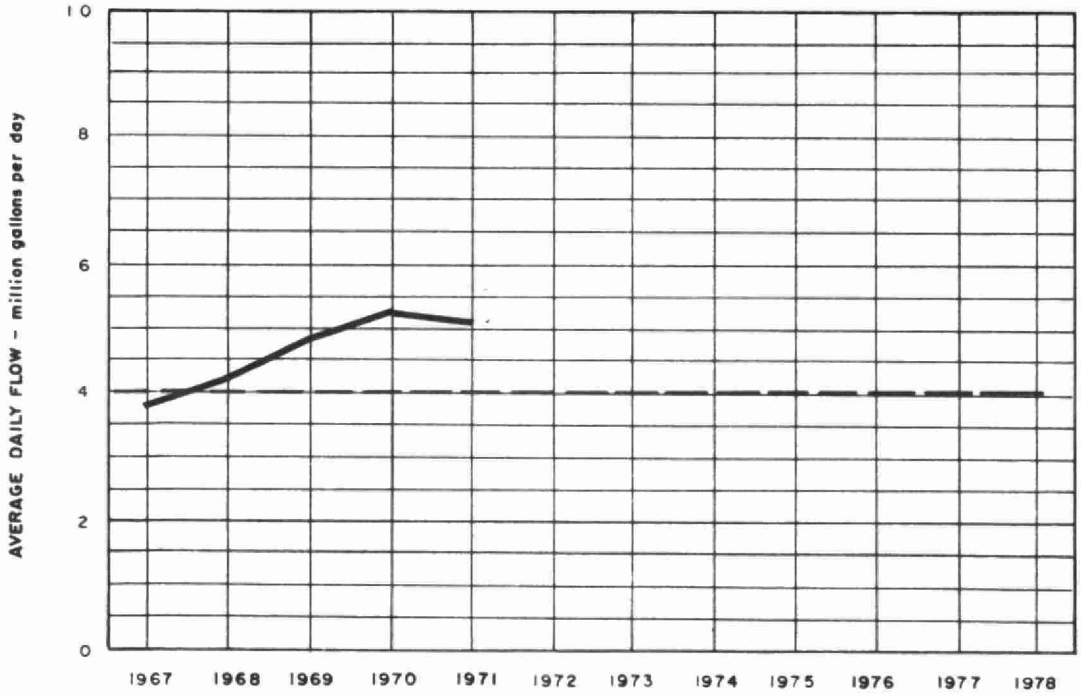
Brackets indicate credit.

* Sundry includes sludge haulage costs of $26,026.00

PROCESS DATA

# FLOWS



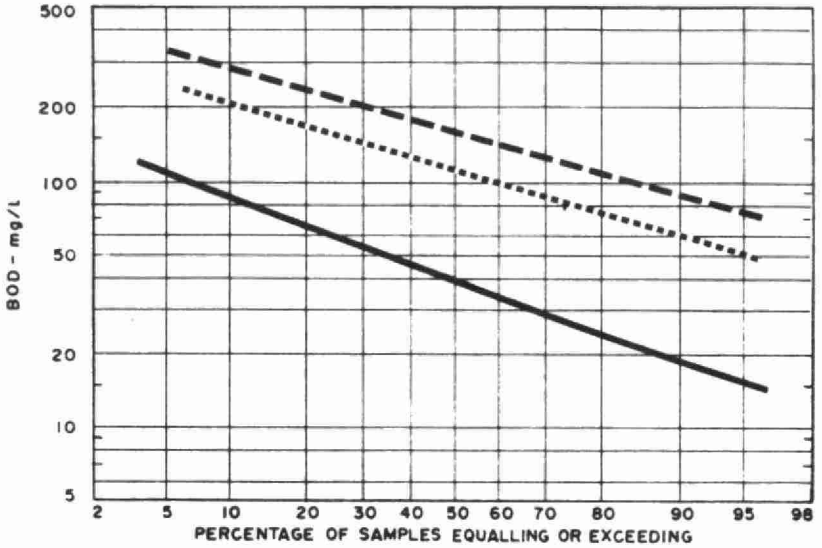



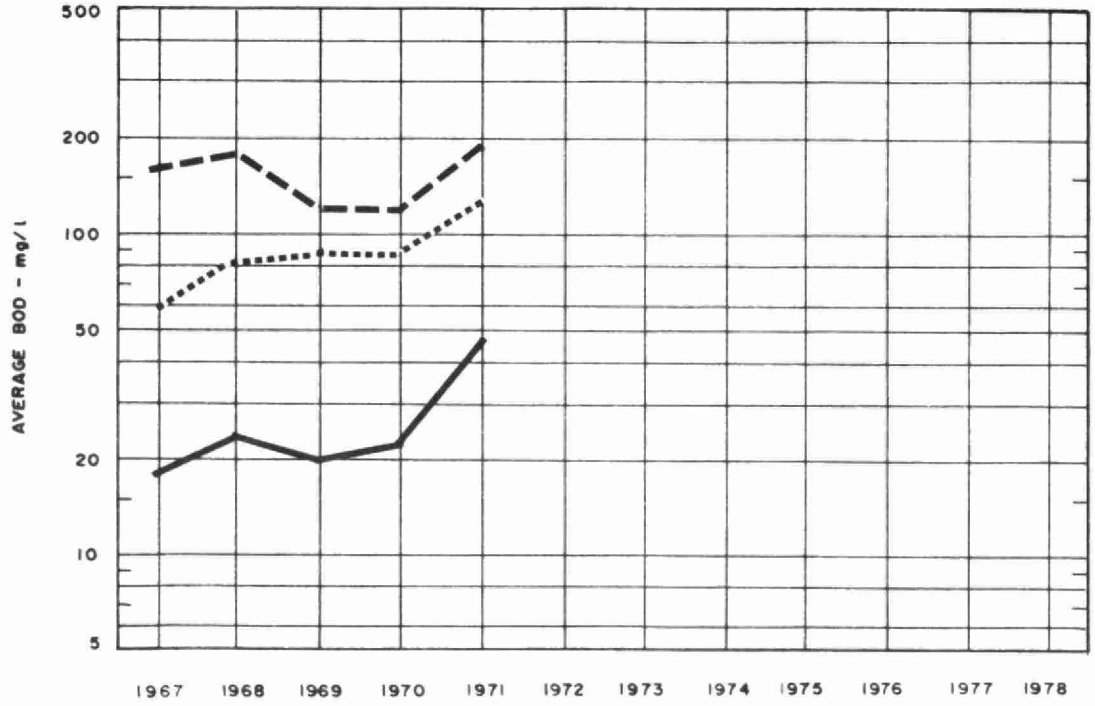

DESIGN CAPACITY _ _ _ _ _ _ _ _

# PLANT PERFORMANCE

| MONTH | FLOWS | | | | BIOCHEMICAL OXYGEN DEMAND | | | | SUSPENDED SOLIDS | | | | TOTAL PHOSPHORUS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOTAL FLOW | AVERAGE DAY | MAXIMUM DAY | MAXIMUM RATE | INFLUENT | EFFLUENT | REDUCTION | | INFLUENT | EFFLUENT | REDUCTION | | INFLUENT | EFFLUENT | REDN |
| | million gallons | mil gal | mil gal | mgd | mg/l | mg/l | % | $10^6$ pounds | mg/l | mg/l | % | $10^6$ pounds | mg/l as P | mg/l as P | % |
| JAN | 140. | 4.5 | 5.3 | - | 260 | 44 | 83 | .30 | 370 | 40 | 89 | .46 | - | - | - |
| FEB | 126. | 4.5 | 6.1 | - | 475 | 37 | 92 | .55 | 695 | 27 | 96 | .84 | - | - | - |
| MAR | 157. | 5.1 | 6.2 | 7.1 | 195 | 37 | 81 | .25 | 275 | 35 | 87 | .38 | - | - | - |
| APR | 219. | 7.3 | 8.6 | - | 140 | 48 | 66 | .20 | 160 | 25 | 84 | .30 | - | - | - |
| MAY | 175. | 5.7 | 6.5 | 6.5 | 170 | 34 | 80 | .24 | 190 | 55 | 71 | .24 | - | - | - |
| JUNE | 159. | 5.3 | 6.6 | 7.2 | 150 | 55 | 63 | .15 | 400 | 60 | 85 | .54 | - | - | - |
| JULY | 150. | 4.8 | 5.7 | 6.1 | 460 | 70 | 85 | .58 | 870 | 110 | 87 | 1.14 | 17.0 | 6.6 | 61 |
| AUG | 150. | 4.8 | 5.3 | 5.8 | 175 | 46 | 74 | .19 | 245 | 50 | 80 | .29 | 9.6 | 3.3 | 66 |
| SEPT | 148. | 4.9 | 6.7 | o/s | 110 | 59 | 46 | .08 | 155 | 60 | 61 | .14 | 9.7 | 4.5 | 54 |
| OCT | 152. | 4.9 | 5.5 | o/s | 194 | 63 | 68 | .20 | 137 | 49 | 64 | .13 | 8.3 | 3.3 | 60 |
| NOV | 149. | 5.0 | 6.3 | o/s | 154 | 57 | 63 | .14 | 154 | 52 | 66 | .15 | 9.4 | 4.6 | 52 |
| DEC | 138. | 4.4 | 8.1 | o/s | 151 | 37 | 76 | .16 | 214 | 34 | 84 | .25 | 6.3 | 2.4 | 62 |
| TOTAL | 1863. | - | - | - | - | - | - | 3.04 | - | - | - | 4.86 | - | - | - |
| AVG. | - | 5.1 | MAXIMUM 8.1 | MAXIMUM 8.6 | 186 | 47 | 75 | .25 | 203 | 46 | 77 | .41 | 8.9 | 3.6 | 60 |
| No. of Samples | - | - | - | - | 38 | 37 | - | - | 75 | 72 | - | - | 13 | 13 | - |

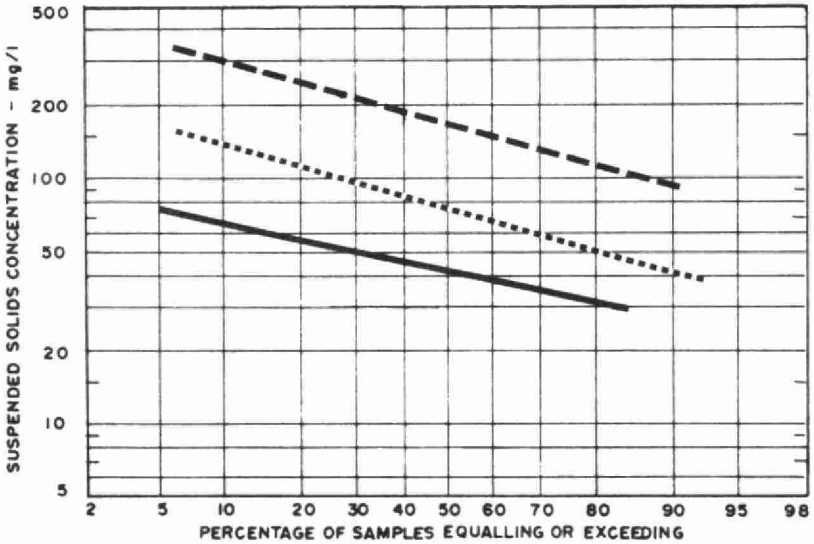
# BIOCHEMICAL OXYGEN DEMAND

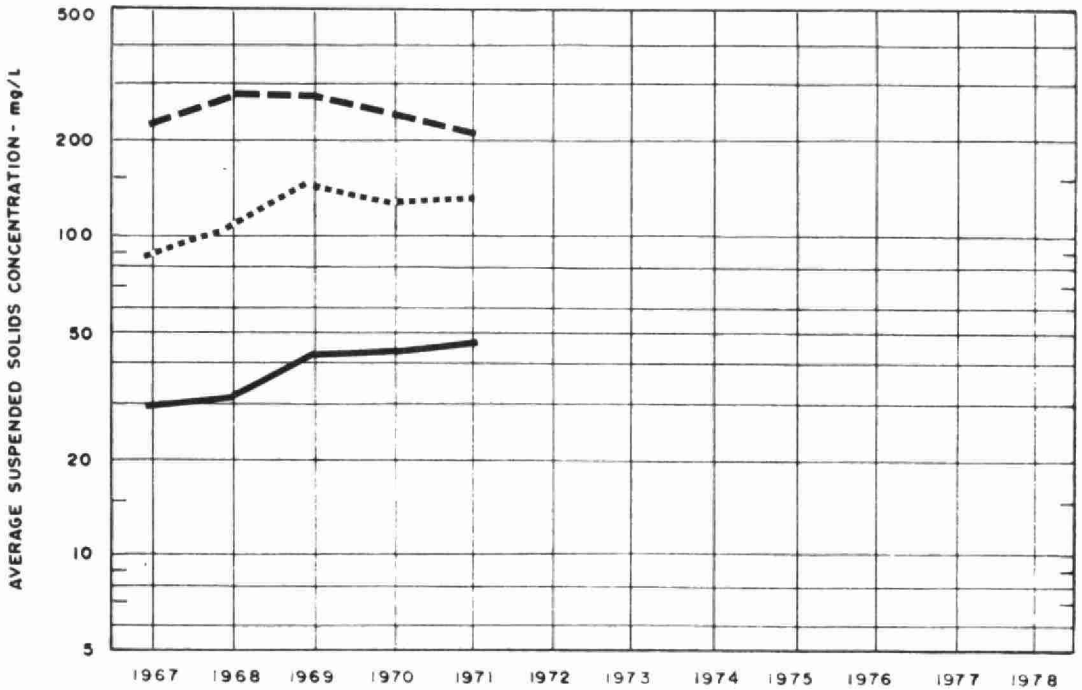



PLANT INFLUENT
PRIMARY EFFLUENT
PLANT EFFLUENT

# SUSPENDED SOLIDS



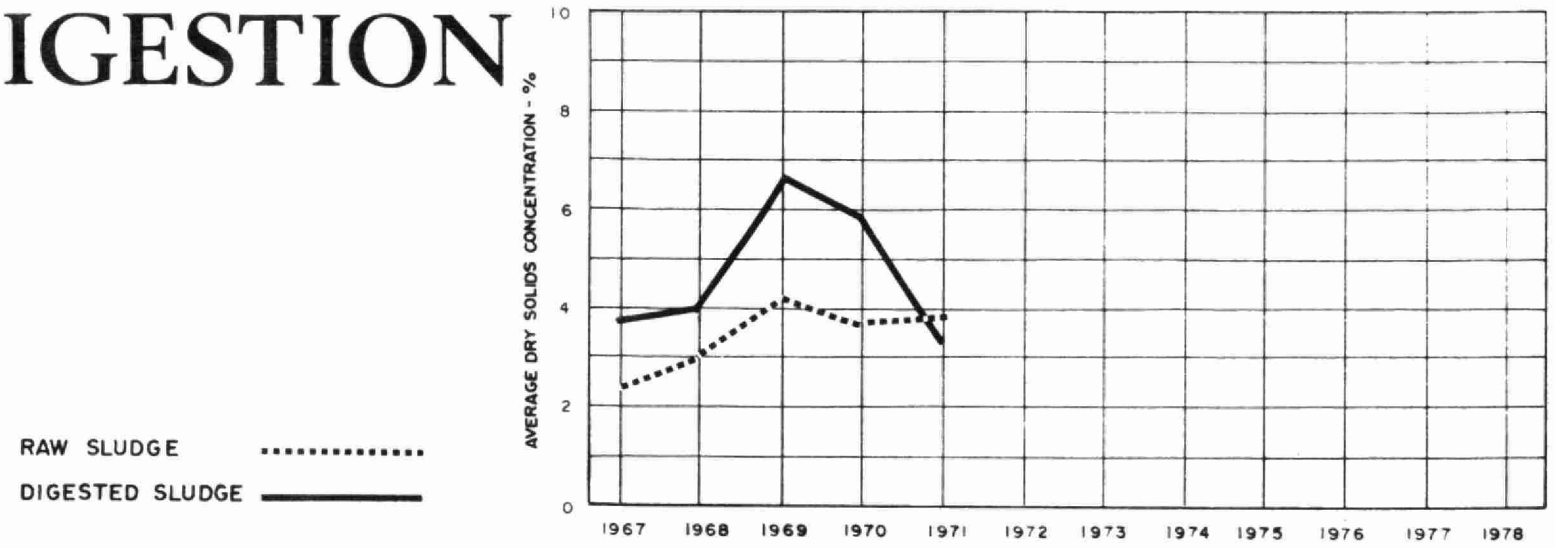



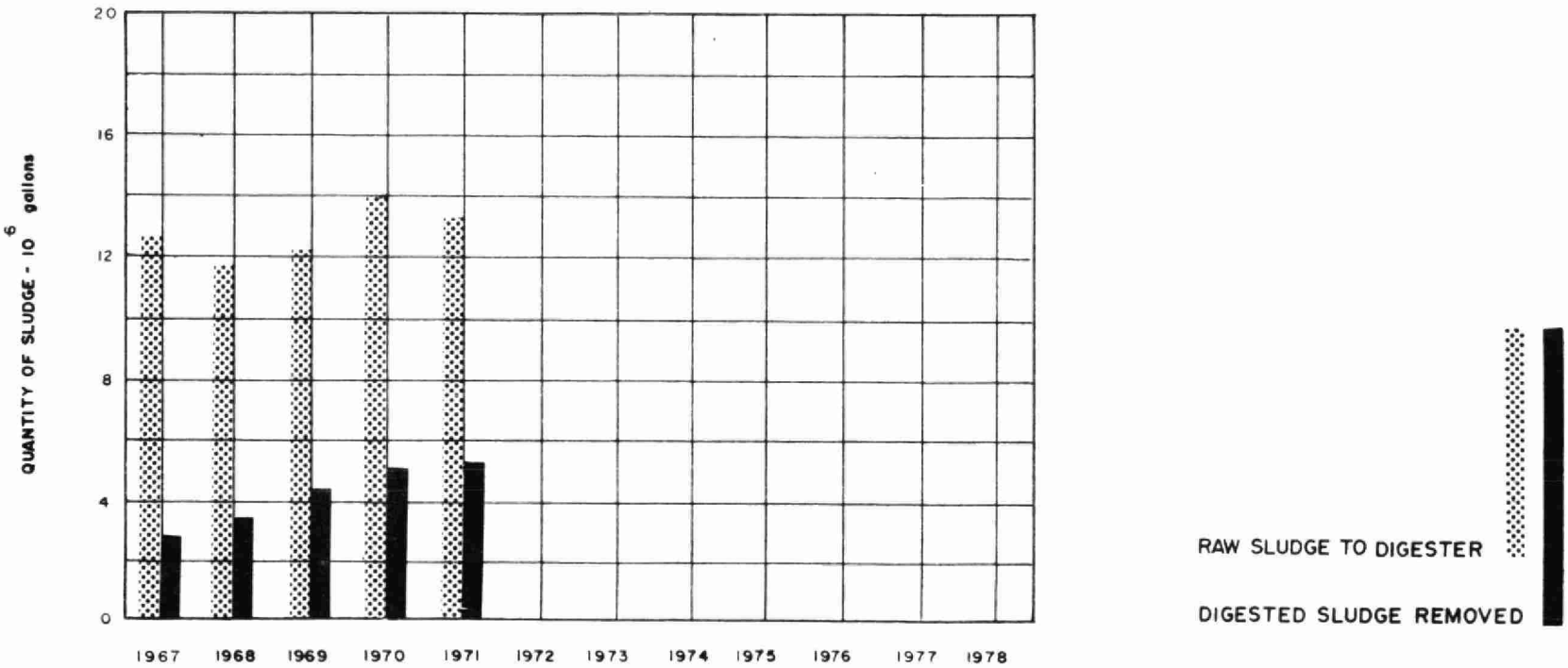

PLANT INFLUENT
PRIMARY EFFLUENT
PLANT EFFLUENT

# TREATMENT DATA

| MONTH | GRIT | CHLORINATION | | PRIMARY EFFLUENT | | AERATION | | | SLUDGE DIGESTION and DISPOSAL | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | RAW SLUDGE | | | DIGESTED SLUDGE | | | SUPER-NATANT T.S. | AMOUNT HAULED |
| | QUANTITY REMOVED cubic feet | $Cl_2$ USED $10^3$ pounds | AVG. DOSE mg/l | BOD mg/l | SUSPENDED SOLIDS mg/l | MLSS CONC mg/l | F/M $day^{-1}$ | AIR $\frac{1000\ ft^3}{lb\ BOD}$ | QUANTITY $10^6$ gallons | TOTAL SOLIDS % | VOL. SOLIDS % | QUANTITY $10^6$ gallons | TOTAL SOLIDS % | VOL. SOLIDS % | % | cubic yards |
| JAN | 1710 | - | - | 220 | 180 | 1450 | .6 | .8 | 1.3 | .7 | - | .5 | 2.4 | - | 2.3 | 3070 |
| FEB | 228 | - | - | 250 | 185 | 1510 | .7 | .6 | 1.2 | 4.6 | - | .46 | 3.4 | - | 1.4 | 2700 |
| MAR | 1140 | - | - | 150 | 205 | 1460 | .5 | 1.0 | 1.3 | 3.6 | - | .65 | 3.8 | - | 1.5 | 3847 |
| APR | 636 | - | - | 85 | 100 | 1460 | .4 | 2.2 | 1.3 | 1.6 | - | .29 | 4.2 | - | .7 | 1747 |
| MAY | 848 | - | - | 74 | 90 | 1450 | .3 | 2.7 | .8 | 5.5 | - | .46 | 1.3 | - | .4 | 2727 |
| JUNE | 1596 | - | - | 75 | 120 | 1360 | .3 | 5.8 | 1.3 | 3.4 | - | .56 | 2.8 | - | - | 3332 |
| JULY | 1140 | - | - | 190 | 250 | 1270 | .7 | 1.0 | 1.3 | 6.7 | - | .46 | - | - | 1.9 | 2742 |
| AUG | 912 | - | - | 122 | 150 | 1060 | .5 | 1.1 | 1.3 | 2.4 | - | .56 | 2.7 | - | 1.0 | 3346 |
| SEPT | 684 | - | - | 80 | 90 | 940 | .4 | 6.0 | 1.3 | 2.7 | - | .66 | 3.0 | - | .2 | 3903 |
| OCT | 1326 | - | - | 165 | 57 | 1160 | .6 | 1.0 | .7 | 5.8 | 60 | .30 | 5.8 | 56 | .5 | 1774 |
| NOV | 1824 | - | - | 138 | 69 | 1460 | .4 | 1.7 | .7 | 4.6 | 69 | .14 | 4.3 | 50 | .3 | 845 |
| DEC | 1518 | - | - | 105 | 82 | 2470 | .2 | 2.9 | .9 | 5.5 | 56 | .29 | 3.6 | 63 | .4 | 1707 |
| TOTAL | 13562 | - | - | - | - | - | - | - | 13.4 | - | - | 5.35 | - | - | - | 31740 |
| AVG. | 7.3 cu. ft/mil gal | - | - | 137 | 132 | 1420 | .5 | 2.2 | 1.1 | 3.9 | 61 | .45 | 3.4 | 50 | 1.0 | 2645 |

# DIGESTION


AVERAGE DRY SOLIDS CONCENTRATION - %
0
2
4
6
8
10
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
RAW SLUDGE
DIGESTED SLUDGE


QUANTITY OF SLUDGE - 10^6 gallons
0
4
8
12
16
20
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
RAW SLUDGE TO DIGESTER
DIGESTED SLUDGE REMOVED